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"Urbanization of innovation".
A case study of the Siemens "Forschungsstadt" in the 1970s.

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Referring to the famous Silicon Valley, a journalist dubbed the city of Munich "Munich Valley", thus indicating Munich's new status as a high-tech city. In the 1980s the city became well known for the high number of its high-tech companies, research institutions and for its three universities. While in the early 19th century Munich was described as a burghers' city, a royal city and a capital city, its image changed in the course of the 19th century. Munich then came to be regarded as an "art city" with lively artistic communities and a university. Finally, in the second half of the 20th century, in particular in the 1980s, the image of the city of Munich has changed again into a "science city" or a high-tech city.

Many scholars have sought to explain Munich's surprising evolution into a high-tech city. Often they have stressed the role of the Siemens company, which moved from Berlin to Munich after World War II. Beyond that they have noted the lack of old industries, the existence of a high number of scientific institutes and universities, the military industry, the attractive countryside around Munich and the lively culture within Munich. Finally, it is claimed that the fact that Munich has no harbour, which was seen as a disadvantage in earlier times, turned into an advantage in the 1970s, the dawn of the information age, because Munich's image was not that of an ugly industrial city.

In the following I do not propose to give any further explanations of Munich's success story. Rather I will analyze the mode of organization of the Siemens-Forschungsstadt ("science city") and its relationship to the city since the 1970s.

Manuel Castells and Peter Hall (1994) have analyzed various "technopoles" all over the world. They have considered science parks, science cities, and national technopolis and techno-belt programmes, which have become a core element of national economic development. Technopoles are an indication of fundamental transformations of economic developments which are closely connected to the emergence of high-tech industries. Taking up their work, I would like to focus on the *spatial* structure of "technopoles" or science cities

as well as on their topography in the city. With important work being done on the re-structuring of space in the context of information technology and on the emergence of “new industrial spaces” (Scott), I will argue that it is not only the industrial geography that has changed. The spatial structure of industrial research areas itself has been re-organized to follow a very stylized model of a city.

In the following, I will first focus on the suburbanization of high-tech industries. Second, I will show the efforts of different actors to *urbanize* these suburban locations. My objective in particular is to show that as soon as knowledge became a very important production factor, an urban environment was considered to be an appropriate mode of organization for scientific-technological innovation; or in a word, to show that a certain idea of the city becomes a model of organizing scientific-technological innovation processes in the so-called knowledge society.

As already mentioned, my case study will be the Siemens-Forschungsstadt, which is located in Neuperlach, a satellite town on the outskirts of Munich which was built in the 1960s and 1970s. The Forschungsstadt itself was built in the 1970s and 1980s. The Siemens company established the science city in Neuperlach in order to get a stake in the market of information technology. In August 1977 the first employees moved from the inner city to the Forschungsstadt on the outskirts. By 1990 around 10,000 people were working in Neuperlach. More than half of them were involved in data processing and information technology.

1. Suburbanization of High-Tech Industries

Whereas “old [traditional] industries” as a rule have moved to the periphery of cities since the end of the 19th century, research institutions and universities in Europe have usually remained located in the city itself for centuries because cities have commonly been regarded as the typical space for creativity and new ideas. A university or research institute on the outskirts of a city was an exception until the 20th century. The few cases in Germany, such as Berlin Dahlem or the University of Tübingen, where universities and an agglomeration of science institutes were sited outside the city at the end of the 19th century, met with resistance. However, in the 1960s these reservations no longer applied. Contrary to the criticism of the 19th century, "modern American institutions", namely the campus, now became the model for building new universities and "science cities" from the 1960s onward.

Now they were sited outside cities. Thus, a dramatic change can be observed in the second half of the 20th century in most European countries. Universities, scientific institutions as well as technopoles or high-tech industries have been situated on the outskirts of cities. We can talk about a "suburbanization" of science and postmodern industry, taking place since the 1960s and 70s. In the case of the city of Munich many new sites of knowledge have emerged on the outskirts of Munich, among these the Siemens-Forschungsstadt in Neuperlach. Out there, no infrastructure, no streets existed, no public transportation was available. These sites of knowledge were created *ex nihilo.* Of course, the relocation of scientific institutions, universities and high-tech industries to the outskirts of cities has considerable consequences for the cities themselves. This question, however, does not fall within the scope of this paper.

Less surprisingly, one main reason for the suburbanization of science and postmodern industries - and this, of course, is true not only of Munich - was the lack of space within cities. But this was not the only reason. Siemens decided to locate its new Forschungsstadt on the edge of Munich for several reasons. When the company discussed the appropriate place for a new Forschungsstadt, it studied the international trends and came to the following conclusions:

First: almost all new industrial research institutes were sited on the outskirts of cities.
Second: they were located close to highways and it was possible to reach them from the city and / or the airport within 10-20 minutes.
Third: the location on the outskirts ensured that scientific work was not impeded by circumstances like air pollution, traffic noise or vibrations caused by underground trains.
Fourth: the prices for real estate were much lower on the outskirts than in the city centre.

Furthermore, the Siemens company was spread out across the city. As the company emphasized, this posed a problem for scientific research, which was becoming increasingly crucial for the company's success. In the 1970s the Siemens management stressed that the spatial fragmentation made interaction and communication between different departments of the company very difficult and complicated. The aim was to concentrate several departments, which were spread all over the city, in one place in order to ensure the spatial proximity of employees to enable their interaction.

The key point here is that this trend towards suburbanization among high-tech industries and research institutes was accompanied by efforts to "urbanize" the new places on the outskirts once knowledge became an important resource for innovation. Since the 1970s and in particular since the 1990s, one can observe that urban planning, science policy and the

administration of companies and universities have striven to *"urbanize"* these emerging suburban areas, where industries and scientific institutions are located. That was also the case for the Siemens-Forschungsstadt.

2. Urbanization of innovation

When the Siemens-Forschungsstadt was built in the 1970s, designing the site proved to be no easy matter. The idea to locate the company's new facility at the edge of the newly built "satellite town" of Neuperlach dates back to the late 1960s. An initial design submitted by the famous architect James Stirling -- a very monumental building -- was rejected. A second design, which was submitted by the architect's office van den Broeck and Bakema was also turned down. Finally, the building department of Siemens worked in close cooperation with van den Broeck and Bakema and adapted the designs. The reason for changing the designs was that Siemens felt that during the planning process the world had completely changed. The company became aware of quickly changing markets, a new need for flexibility as well as the growing importance of knowledge in the innovation processes. Consequently Siemens decided it needed a new kind of concept for the planned research facility.

The core of the new concept was the idea to build the new research area as a *city*. Thus we have to take a closer look at the architecture and the spatial structure of the Siemens-Forschungsstadt.

The location is organized essentially as a diagonal net structure consisting of several small-sized individual buildings. This layout makes it possible to enlarge the area at any time. When one walks around the site, it seems complex and full of corners. From a bird's eye view, on the other hand, there is a clear and regular cross-shaped ground-plan which however is constantly interrupted in order to create courtyards, pathways and small meadows. Just as townscapes are characterized by a succession of squares and open spaces, streets bordered by buildings and numerous connecting paths, the buildings on the site have been built as space-defining elements and hence allow open spaces to arise. Different urban places have been built; trees and lawns as well as "streets" can be found. Every building is individual; none looks like the copy of another; which was thought to enhance the sense of being in a city.

The Forschungsstadt was planned as a compact urban area with short distances. Thought was given to creating an urban atmosphere with the building of shops and libraries as well as a "communication centre" which is intended to support communication between the

employees. In short, the objective was to establish infrastructures to enable a social life, interaction and communication. One aim was to “bridge the gap between the work space and private space.”

The choice of such an urban design in the case of the Siemens-Forschungsstadt has to be seen in the context of a “knowledge society”. Siemens emphasized that such an urban design corresponded to the mode of knowledge production since the 1970s when knowledge had become one of the most important resources for innovation.

If we consider what characteristics of a city or urban environment are capable of stimulating scientific, technological innovation, then we find there are two chief aspects: first, the increasing need for flexibility; and second, the believed requirement of interaction and communication for creativity and the production of scientific-technological innovation.

1. The need for flexibility

The literature has observed the permanent change of markets and the increasing need for flexibility which changed the production system around the 1970s (e.g. Piore / Sabel). At this time Siemens had also observed that tasks, demands and markets had permanently changed. The company thought about an appropriate mode of production capable of reacting to these changes. In terms of spatial organization Siemens believed that the construction of several small buildings instead of one big building -- as was usual before -- would enable the company to react fast to changes in the market. As already mentioned, laying out the Forschungsstadt as a “city” made it possible to add different buildings of various sizes, according to what was necessary in view of developments on the market.

Morever, Siemens planned 30 % of the whole research area as “reversible spaces” which had no function at the beginning. No fixed walls were built; instead it was possible to change the walls within the individual buildings in order to deal with any new tasks that might necessitate a different utilization of space.

As Siemens pointed out, this adaptability of space was necessary because, when the company started the planning process of the new Forschungsstadt, it did not know what tasks the employees would be working on since the world was changing so fast. Moreover, Siemens regarded it as absolutely impossible to anticipate what be on the agenda in 5 to 10 years’ time. Thus, Siemens maintained, it was not possible to make any definite plans about the utilization of space, the number of employees or tasks.

"Explosive technological development and increasing specialization in research have led to new forms of cooperation within a research company. The consequence of this is new conditions for the organization and rhythm of work, which in turn have a bearing on lab design and facilities. (...) The close interconnection of science and technology means that the spatial layout of a science building must be technically flexible enough to allow rapid adaptation to changing tasks. (…) This led to the evolution of a modular construction system."[1]

Robert Venturi summarized the requirements of science buildings in a very similar way:

"This is more and more relevant in science buildings in particular and in architecture in general, to accommodate change that is more characteristically revolutionary than evolutionary and that is dynamically wide in its range: spatial, programmatic, perceptual, technical, iconographic. In our time, functional ambiguity rather than functional clarity can accommodate the potential for "things not dreamt of in your philosophy".[2]

Thus, the modular structure of the Forschungsstadt, the high number of individual buildings seemed to offer a solution in a permanently changing world. As an urban environment, which never is static, which will never be finished, which is continually re-built and constantly responding to change, science buildings were supposed to be flexible, unfinished and also able to react to changes.

2. Knowledge and creativity

"Through concentration and interaction we expect the growth of ideas and creativity."[3]

At the moment when knowledge became an important resource for economies, the urban mode of organization of "science cities" and research areas was discovered. Companies as well as politicians referred to the idea of the city as the genuine place of creativity. The central role of cities in the generation of new ideas, creativity, innovation and knowledge has been a matter of course for centuries. It is claimed that they offer the most appropriate setting for the pursuit of art, culture, scientific activity and for technological innovation. Theories and ideas are usually not generated in rural areas, but in lively, heterogeneous cities. Thereby, urban communication and personal interaction are emphasized as an essential condition for

[1] Files (not in the official archive) of the Siemens location Neuperlach. Bauen für die Forschung.
[2] Robert Venturi, Thoughts on the Architecture of the Scientific Workplace: Community, Change, and Continuity, in: Peter Galison / Emily Thompson (Hrsg.), The Architecture of Science, Cambridge / London 1999, S. 385-398, hier S. 390.
[3] Siemens-Mitteilungen, Heft 11/ 1976, S. 6.

creativity. The fact that cities are traditionally defined as the typical place of innovation and creativity depends on specific features that are ascribed to the city in general, namely their characteristics as a social space, as a space of interactions, of networks and plurality. It was precisely these features to which companies and science institutions started to refer in the 1970s, and in particular in the 1990s. The Siemens' management stressed the importance of the concentration and the intercommunication of different departments, which, as the management felt certain, would lead to greater creativity:

"A physician, an engineer, a mathematician – they all need incentives, communication and interaction with each other… If we concentrate their work in one place and enable their communication they will be much more creative."[4] These considerations were the background for the concentration of different departments in Neuperlach and for the simulation of an urban atmosphere. Communication and interaction evolved into management tools in order to enhance the output of ideas. Architecture was regarded as a medium to promote these processes.

The fact that communication and interaction between the employees was so strongly emphasized is, as I argued above, connected with knowledge becoming a decisive resource in the innovation process. While aspiring to create an urban design so as to facilitate communication and interaction, Siemens employed the concept of the city in a very stylized manner. The Siemens-Forschungsstadt copied urban structures and tried to create an urban environment in order to stimulate innovation and creativity. The concept of the city was used in a reduced way which focused on certain features of the city such as flexibility, modularity, compactness, density, short distances, the possibility of interaction and communication and above all the idea of the city as a space of creativity. One could say that this concept of the city is a very specific one, which was adapted to the needs of a company aiming at improving the output of technological-scientific innovations. A paradoxical situation may be observed here: while companies, universities and scientific institutions move out of cities, the idea of the city becomes a model for generating innovation.

Siemens was no exception. Particularly since the 1980s and 1990s the new guiding principles for the spatial organization of research areas, technopoles, etc. have been urbanism, interaction, face-to-face communication, interchange and networking among scientists, politicians and companies. The lack of an urban environment in the outskirts is compensated by newly constructed localities and social infrastructures such as "urban centres", squares,

[4] Siemens-Mitteilungen, Heft 11/ 1976, S. 6

fountains, shops etc. An artificial urban environment is built in order to bring about an innovative and creative atmosphere. Thus, certain features of the city are copied in order to stimulate innovation processes.

Without any doubt, this urbanization of innovation processes is closely connected to the emergence of the high-tech industry and to the growing importance of knowledge in innovation processes. Thus the emergence of high-tech industries has changed both the spatial structure of cities as well as the organization of industrial research.